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(54) **IMAGE DISPLAY APPARATUS AND IMAGE DISTORTION CORRECTION METHOD OF THE SAME**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,784,742 A * 1/1974 Burnham et al. 348/123
(Continued)

FOREIGN PATENT DOCUMENTS

JP 200248711 5/2002
(Continued)

OTHER PUBLICATIONS

English language Abstract of JP 2002-148711, May 22, 2002.
(Continued)

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(57) **ABSTRACT**

An image display apparatus includes a projector receiving an image signal and projecting image light and a screen including a projection plane of arbitrary shape. The projector and screen are connected with link mechanisms and link mechanisms. The relative position and posture between the projector and the screen are automatically or manually changeable. The relative position and posture between the projector and the screen are measured, and correction parameters for correcting distortion of image light projected from the projector onto the screen are calculated from the previously set viewing position of the viewer and the shape of the projection plane of the projector. Based on the calculated correction parameters, the image signal inputted into the projector is subjected to distortion correction processing. It is therefore possible to allow the viewer to see a clear image even if the position of the screen is changed.

23 Claims, 27 Drawing Sheets